

## PATENT ABSTRACTS OF JAPAN

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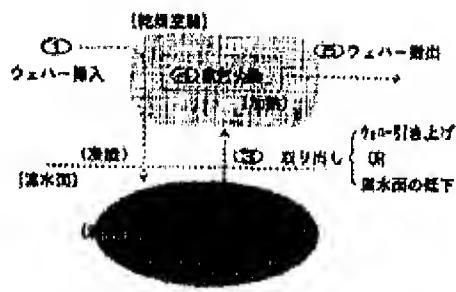
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## (54) SEMICONDUCTOR WAFER CLEANING AND DRYING METHOD AND APPARATUS

## (57)Abstract:

PROBLEM TO BE SOLVED: To ensure safe, efficient and economical cleaning of a semiconductor wafer and drying of the wafer after cleaning.

SOLUTION: This method comprises steps of carrying a semiconductor wafer above the surface of hot water of a predetermined temperature, dipping the semiconductor wafer into the hot water of a predetermined temperature, cleaning and heating the semiconductor wafer; taking out the cleaned semiconductor wafer above the surface of the hot water and drying the semiconductor wafer in a pressure-reduced and dry space by heating; and carrying the dried semiconductor wafer from the dry space above the hot water.



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CLAIMS

## [Claim(s)]

[Claim 1] A warm-water tank possessing a covering mechanism which is a warm-water tank which receives warm water for semiconductor wafer washing, can open and close selectively, and can decompress drying space of the upper part of a warm water side at the time of closing. A semiconductor wafer soaping-machine style for a case which carried out number-of-sheets juxtaposition accommodation suitably being immersed into said warm water, and performing washing and temperature up so that a semiconductor wafer may not stick mutually, and taking out to drying space of the warm water upper part after a predetermined washing distance. A tubular heater inserted all over a gap of the semiconductor wafers taken out by this semiconductor wafer soaping-machine style on a warm water side. Washing and a dryer of a semiconductor wafer having a conveyer style of a semiconductor wafer case for carrying in a semiconductor wafer case before washing, laying on said semiconductor wafer soaping-machine style, and taking out after the completion of washing.

[Claim 2] Washing and a dryer of the semiconductor wafer according to claim 1 forming an infrared heater for heating drying space of said warm-water tank upper part.

[Claim 3] Washing and a dryer of the semiconductor wafer according to claim 1 forming an apparatus for generating ion for removing static electricity in drying space of said warm-water tank upper part.

[Claim 4] Washing and a dryer of the semiconductor wafer according to any one of claims 1 to 3 characterized by providing a semiconductor wafer case rising and falling mechanism in order to immerse a semiconductor wafer case into warm water and to take it out after the completion of washing in said semiconductor wafer soaping-machine style.

[Claim 5] Washing and a dryer of the semiconductor wafer according to any one of claims 1 to 3 providing a warm water pump which fluctuates a hot water amount in said warm-water tank in order to immerse a semiconductor wafer case into warm water and to take it out after the completion of washing in said semiconductor wafer soaping-machine style.

[Claim 6] Washing and a drying method of a semiconductor wafer characterized by comprising the following. A process of conveying a semiconductor wafer on a warm water side of prescribed temperature, and this semiconductor wafer being immersed into warm water of prescribed temperature, and performing washing and temperature up.

A process of drying taking out a semiconductor wafer after washing on a warm water side, and heating it further in decompressed drying space, and a process of taking out a semiconductor wafer which desiccation ended from drying space on a warm water side.

[Claim 7] Washing and a drying method of the semiconductor wafer according to claim 6 which adds ion made to be generated with an apparatus for generating ion into drying space atmosphere in a process of drying said semiconductor wafer, and is characterized by removing static electricity.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Field of the Invention]** This invention relates to a device suitable for enforcing the method of performing washing and desiccation of a semiconductor wafer, and the method of starting.

**[0002]**

**[Description of the Prior Art]** In the manufacturing process of various semiconductor devices, a detailed fragment, processing refuse, etc. have adhered to the cut surface of a semiconductor wafer in many cases. Unless the suitable quality control of a semiconductor wafer is performed, maintenance of product quality will not be able to be performed, but the yield will also fall.

**[0003]** Washing and desiccation of a semiconductor wafer are the things of the quality control in a semiconductor device manufacturing process which can also be most said to be a basal condition.

It is necessary to carry out efficiently and certainly.

If it does not dry appropriately in particular, what is called a watermark in which the trace of waterdrop remains will be formed in a wafer surface. Since trouble arises in the semiconductor production process which will continue if such a watermark and dust have adhered, the yield falls.

**[0004]** Although various kinds of methods are proposed by desiccation after washing of a semiconductor wafer, at the present, the method of removing chemically using alcohol and the method of removing physically according to a centrifugal force are adopted widely.

**[0005]** The method of using the former alcohol is also called the IPA (isopropyl alcohol) method, and after making the moisture which \*\*\*\* the semiconductor wafer after desiccation in alcohol, and has adhered melt into alcohol, the cooled space is made to place and dry it. This method can prevent the damage over a wafer, generating of a watermark, etc., and is accepted to be an appropriate means.

**[0006]** However, since alcohol itself has high volatility, it is necessary to always fill up alcohol of quantity suitably for example, and there is a fault in which a sustaining cost increases like 100,000 yen - about 150,000 yen per day in a standard device. Since there is a risk of vaporized alcohol stagnating indoors and igniting, an antifire provision is indispensable, and there is concern which has an adverse effect also on atmosphere or natural environment.

**[0007]** The method of using the latter centrifugal force is also called the spin dryer method, places a wafer into the device which carries out a high velocity revolution, and removes the moisture adhering to the surface. This method has an advantage which can be processed extensive by enlarging a device.

**[0008]** However, control of an operating condition is difficult and may do damage to a wafer. Since it is a mechanical water removal method, adhesion of detailed dust may be caused between dry distance, and improvement in productivity has a limit.

**[0009]**

**[Problem(s) to be Solved by the Invention]** This invention cancels the fault of the above-mentioned conventional technology, and an object of this invention is the desiccation after washing of a semiconductor wafer, and washing safety and to provide feasible washing and drying method, and washing and a dryer efficient and economically.

**[0010]**

**[Means for Solving the Problem]** As shown in drawing 1, SUBJECT of this invention carries in \*\* semiconductor wafer on a warm water side of prescribed temperature, and immerses \*\* this semiconductor wafer into warm water of prescribed temperature. Take out a process of performing washing and temperature up, and a semiconductor wafer after \*\* washing, on a warm water side, and \*\* decompression A process of drying heating further in drying space carried out, \*\* It is solved by process of taking out a semiconductor wafer which desiccation ended from drying space on a warm water side, and washing and a drying method of a semiconductor wafer, \*\* and others.

**[0011]** In a drying process of a semiconductor wafer, SUBJECT can be more advantageously solved by impressing ion made to be generated with an ion generator to drying space, and removing static electricity.

**[0012]** In order to immerse a wafer into warm water and to take it out on warm water after the completion of washing in a wafer washing process, can \*\* carrying out according to a rising and falling mechanism for descending and raising the semiconductor wafer case holding mechanism itself, but. A warm water pump for fluctuating a hot water amount in a warm-water tank if needed can also perform.

**[0013]** A device provided with each element for carrying out each process of a described method can attain SUBJECT of this invention more advantageously.

**[0014]** Namely, the warm-water tank 10 possessing the covering mechanism 14 which SUBJECT of this invention is

a warm-water tank which receives the warm water 12 for semiconductor wafer washing, can open and close selectively, and can decompress drying space of the upper part of a warm water side at the time of closing, A semiconductor wafer soaping-machine style for a case which carried out number-of-sheets juxtaposition accommodation suitably being immersed into said warm water 12, and performing washing and temperature up so that a semiconductor wafer may not stick mutually, and taking out to drying space of the warm water upper part after a predetermined washing distance, The tabular heater 20 inserted all over a gap of the semiconductor wafers taken out by this semiconductor wafer soaping-machine style on a warm water side, A semiconductor wafer case before washing is carried in, and it lays on said semiconductor wafer soaping-machine style, and is solved by washing and a dryer of a semiconductor wafer which has a conveyer style of a semiconductor wafer case for taking out after the completion of washing.

[0015]The infrared heater 22 for heating drying space of said warm-water tank upper part can be formed in drying space of said warm-water tank upper part.

[0016]The apparatus for generating ion 24 for removing static electricity can be formed in drying space of said warm-water tank upper part.

[0017]In order that a device concerning this invention may immerse a semiconductor wafer case into warm water and may take it out after the completion of washing in said semiconductor wafer soaping-machine style, the semiconductor wafer case rising and falling mechanism 18 is provided.

[0018]In said semiconductor wafer soaping-machine style, in order to immerse a semiconductor wafer case into warm water and to take it out after the completion of washing, a warm water pump which fluctuates a hot water amount in said warm-water tank is provided.

[0019]Thus, washing and desiccation are performed by short processing time, without causing the undesirable situations, such as damage, generating of a watermark, and adhesion of dust, to a semiconductor wafer according to the device for carrying washing and a drying method of a semiconductor wafer, and this concerning this invention out. Warm water is only used, there is also no adverse effect to environment, and employment cost is also cheap.

[0020]

[Embodiment of the Invention]Next, suitable working example which materialized this invention is described, referring to an attached drawing. Drawing 2 is a basic constitution explanatory view of washing and the dryer of the semiconductor wafer concerning this invention.

[0021]In a figure, the warm-water tank 10 can accommodate the warm water 12 for washing of the specified quantity. The warm water 12 for washing is pure water (distilled water) which does not contain an impurity, and is controlled to become the water temperature of about 55-70 \*\*.

[0022]Although molecular motion activates, washing becomes easy, and the one where this temperature is higher is set as the above ranges in consideration of influence, practical permissible washing time, economical efficiency, etc. to a semiconductor wafer, it is 60-63 \*\* still more preferably 58-65 \*\* preferably.

[0023]This warm-water tank 10 for washing is provided with the covering device 14 which moves up and down, for example like both the head arrow A in order to form selectively the drying space decompressed in the warm water side upper part. In order to perform decompression which is needed at the time of desiccation, the sliding packing 15 is formed in the joined part of the upper part outer edge section of the warm-water tank 10 for washing, and the covering device 14.

[0024]As this sliding packing 15, it can be considered as tube packing which can acquire an airtight condition and an opened condition selectively by for example making inner air pressure fluctuate. Decompression of the drying space formed in covering device 14 inside is performed by the decompressing means of the covering device 14 which the communication trunk 16 is suitably formed in the part, and is not illustrated.

[0025]The wafer case lifting device 18 for a semiconductor wafer to move up and down the wafer case by which number-of-sheets juxtaposition was carried out suitably like both the head arrow B is formed in the inside of the covering device 14, i.e., drying space.

[0026]Since a semiconductor wafer case is immersed in warm water, the operation for taking out out of warm water is not limited to the gestalt performed by rise and fall of such a wafer case itself, but should just be performed relatively.

[0027]For example, a semiconductor wafer case can also be carried out by making the hot water amount in the warm-water tank 10 fluctuate with the warm water pump which is not illustrated, without making it fluctuate, and making a warm water side go up and down.

[0028]All over the drying space in the covering device 14, the tabular heater 20 of working and the infrared (IR) heater 22 are allocated further. This tends to avoid the situation where quench with evaporation heat and desiccation is delayed, if the semiconductor wafer by which temperature up is carried out simultaneously with washing in warm water can pull up to the decompressed space.

[0029]The tabular heater 20 of working is a tabular heater of two or more sheets which is mutually parallel, When each heater element enters in non-contact in the gap of the semiconductor wafers which exercise like both the head arrow C and are laid in the semiconductor wafer case and surrounds a semiconductor wafer from both sides, A semiconductor wafer prevents rapid cooling and temperature fall at the time of seceding from a warm water side, and it is going to promote desiccation.

[0030]The infrared heater 22 heats the drying space in the covering device 14 widely, and is allocated in the part which does not bar above-mentioned arrangement and operation of each element. The suitable cooking temperature of this infrared heater 24 is about 75-90 \*\* practically.

[0031]The ion generator 24 is allocated in the proper part of the inner surface of the covering device 14 as a static eliminator. By making ion exist in the decompressed drying space, this ion generator 24 removes the static electricity of a semiconductor wafer, and prevents adhesion of dust.

[0032]The outline of operation of washing and the dryer of the semiconductor wafer of composition like working example shown in drawing 2 becomes as it is shown in the flow chart of drawing 3.

[0033]In the start of washing of a semiconductor wafer, the covering device 14 is opened wide and the warm water of the specified quantity is filled to the warm-water tank 10 (Step S1).

[0034]The wafer case which carried out juxtaposition accommodation of the semiconductor wafer of a predetermined number is moved on a warm-water tank (Step S2). As for this movement, it is preferred that you are made to stop to the prescribed position on a warm-water tank by the automatic transportation device which is not illustrated.

[0035]Subsequently, a semiconductor wafer is immersed into the warm water of the warm-water tank 10, and a washing process is started (Step S3).

[0036]The covering device 14 is dropped simultaneously, it is considered as an airtight condition, a vacuum pump is operated, and drying space is decompressed (step S4). The tabular heater 20, the infrared heater 22, and ion generator 24 grade are started (Step S5).

[0037]Subsequently, it judges whether washing of the semiconductor wafer was completed (Step S6), and said washing process is continued until washing is completed.

[0038]When washing of a semiconductor wafer is completed, a semiconductor wafer is pulled up on a warm water side, and simultaneously with this, by each element of the tabular heater 20, each semiconductor wafer is put by non-contact (Step S7), and it goes into a drying process (Step S8).

[0039]Then, it judges whether desiccation of a semiconductor wafer was completed (step S9), and it continues until it ends. When judged with desiccation having been completed, each element of removal of the tabular heater 20, the infrared heater 22, and ion generator 24 grade is stopped, and the covering device 14 is opened (Step S10).

[0040]Subsequently, the case of the semiconductor wafer which desiccation ended is taken out outside from drying space (Step S11).

[0041]Then, the operation after Step S2 is repeated until it judges whether all the work of washing and desiccation of a semiconductor wafer was completed (Step S12) and all the work is completed.

[0042]Drawing 4 shows one example of washing and the dryer of the semiconductor wafer concerning this invention, and receives the basic constitution of drawing 2. The carrying means for moving the carrying in means for moving the semiconductor wafer case before washing on the warm water side for washing and the semiconductor wafer case after the completion of dry outside from on the warm water side for washing is added.

[0043]The device 30 which carries out predetermined number installation accommodation of the semiconductor wafer at a wafer case, i.e., a loader, Washing and desiccation of a more advantageous semiconductor wafer are carried out by the basis of Automatic Control Division by installing the device 40 for taking out the dried semiconductor wafer by which predetermined number installation accommodation was carried out to a wafer case, i.e., an unloader, in the upstream and the downstream.

[0044]

[Effect of the Invention]According to washing, drying method, and device of a semiconductor wafer concerning this invention, as explained above, since usual warm water washes on the occasion of washing and desiccation of a semiconductor wafer, there is no fear, such as environmental pollution and a fire, and economical work is attained.

[0045]It is maintained by the temperature of about 60-70 \*\*, the molecule is activated, and the warm water used in this invention can expect sufficient detergency. When the temperature of a semiconductor wafer rises and it shifts to a drying process further in the warm water between this washing process, in order for a tabular heater to approach a semiconductor wafer and to heat, the drying efficiency in the drying process after the end of washing is attained.

[0046]The drying space for a drying process is equipped with the infrared heater which carries out heating heat insulation of the whole space widely, and the drying effect of a semiconductor wafer can be heightened.

[0047]Since the ion by an ion generator is impressed to drying space, the static electricity to a semiconductor wafer is eased by it, and adhesion of dust is prevented in it. Therefore, washing and desiccation of an efficient semiconductor wafer are performed.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

[Drawing 1]It is the hot water washing of a semiconductor wafer and the key map of a drying method concerning this invention.

[Drawing 2]It is the hot water washing of a semiconductor wafer and the basic constitution figure of a dryer concerning this invention.

[Drawing 3]It is a flow chart showing the example of the hot water washing of a semiconductor wafer, and the basic motion of a dryer concerning this invention.

[Drawing 4]It is the hot water washing of a semiconductor wafer and the basic constitution figure of working example of a dryer concerning this invention.

**[Description of Notations]**

10 Warm-water tank

12 Warm water

14 Covering device

15 Tube packing

16 Pressure reducing device communication trunk

18 Semiconductor wafer case lifting device

20 Tabular heater

22 Infrared (IR) heater

24 Ion generator

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**[Translation done.]**